CLAIMS

I claim:

1. A metering device, said metering device incorporating an elongate chamber, there being a shuttle contained within the chamber, the shuttle having a portion which is a substantially sealing sliding fit within the chamber, the shuttle being movable axially between an initial position and a second a second position within the chamber, each end of the chamber defining fluid flow means through which fluid may enter and leave the chamber, there being valve means adapted to control the flow of fluid to and from the chamber such that, during successive cycles of operation the metering device, fluid is supplied to one end of the chamber causing the shuttle to move from the initial position at said one end of the chamber to the second position at the other end of the chamber thus ejecting a predetermined volume of fluid from the chamber, and subsequently fluid is supplied to said other end of the chamber causing the shuttle to move back from the second position to the initial position again ejecting a predetermined quantity of fluid from the chamber, the valving means comprising a spool valve having a spool sealingly slidable within a bore, the spool valve being associated with means to drive the spool between two alternate positions in response to the shuttle reaching the initial position or the second position, the spool, in one position creating a fluid flow path for pressurized liquid from a fluid flow inlet duct to the fluid flow means at one end of the chamber, and also creating a fluid flow path from the fluid flow means at the other end of the chamber to a fluid flow outlet duct, and in a second position creating a fluid flow path for pressurized liquid from a fluid flow inlet duct to the fluid flow means at the other end of the chamber, and also creating a fluid flow path from the fluid flow means at said one end of the chamber to said fluid flow outlet duct.

2. A device according to claim 1, wherein the spool is moved by a motor arrangement, the motor arrangement being controlled by a control unit in response to a signal generated in response to the shuttle reaching the initial position or the second position.

3. A unit according to claim 2 wherein the shuttle is provided with two shuttle rods, each shuttle rod extending beyond the chamber, there being a respective movement limiting member located adjacent each rod, contact being established between a rod and a respective movement limiting member when the shuttle reaches the initial position and the second position to generate said signal, at least one of the movement limiting members being adjustably positioned.

4. A device according to claim 3 wherein each movement limiting member is electrically conductive, the shuttle and shuttle rods are electrically conductive and the element defining the chamber contained in the shuttle is electrically conductive, the arrangement being such that when a shuttle rod contacts a movement limiting element, an electric circuit associated with the control device is completed.

5. A device according to any one of the preceding claims wherein the spool of the spool valve comprises four spaced apart sections, each of which is a sealing sliding fit within the bore that contains the spool, the four sections being interconnected by three relatively narrow necks, the fluid flow inlet always being in communication with the space surrounding the central narrow neck when the spool is in or being moved between the two alternate positions and a respective part of the fluid flow outlet duct always being in communication with the spaces surrounding each of the other two necks, there being flow ports at spaced locations along the axis of the bore containing the spool which communicate with the fluid flow means provided in the chamber containing the shuttle, the flow ports being positioned such that in one position of the spool a flow port that is in communication with the flow means at one end of the chamber containing the shuttle is open to permit fluid flow from the region surrounding the central neck and a flow port that is in communication with the fluid flow means at the other end of the chamber containing the shuttle is open to permit fluid flow to the space surrounding one of the outer narrow necks, and in the other position of the spool a fluid flow port that is in communication with the other end of the chamber containing the shuttle is open to permit fluid flow from the region surrounding the central neck, and a fluid flow port that is in communication with the fluid flow means at said one end of the chamber containing the shuttle is open to permit fluid flow to the space surrounding the other of said outer necks.

6. A device according to any one of the preceding claims provided with a valve connected to said outlet flow duct, the valve being positionable to direct the flow of fluid from the outlet duct to a selected one of a plurality of discharge ports.

7. A device according to claim 6 where one of the discharge ports is a main discharge port, and a second of the ports is a leakage test port.

8. A device according to claim 7 wherein a third discharge port is provided which is a sampling port.

9. A device according to any one of claims 6 to 8 wherein the valve comprises a cylindrical valve member slidably mounted within a cylindrical bore to execute a predetermined axial movement, the valve member having a central portion of a first diameter which is a substantially sealing sliding fit within the bore, and having two axially extending valve rods of less diameter which pass through respective seals at opposed ends of the bore, the valve member having a central chamber defined therein, there being fluid flow ports communicating with the central chamber and the exterior of the valve member provided, respectively, on each of the valve rods and on the central cylindrical portion, the space surrounding each of the valve rods being in fluid flow communication, regardless of the position of the valve member, within said predetermined movement, with the fluid flow outlet duct from said spool valve, the valve member having an outlet formed in the cylindrical portion thereof adapted to be aligned, depending upon the position of the valve, with each one of the discharge ports.

10. A method of measuring the leakage of a metering device according to any one of claims 6 to 9 comprising the steps of positioning the valve member so that the outlet in the cylindrical portion thereof is aligned with the leakage test port, positioning the spool centrally so that the region surrounding the central neck is not in communication with any flow port and applying high pressure fluid to the fluid flow inlet duct and determining if any fluid exits from the leakage port.

11. A method according to claim 10 comprising the additional step of moving the spool to one of the two alternate positions whilst still supplying fluid to the inlet.

12. A method of sampling the operation of a device according to claim 8 comprising the steps of moving the valve member so that the outlet in the cylindrical portion thereof is aligned with the sampling port, and operating the metering device for a predetermined number of strokes of the shuttle and volumetrically measuring the quantity of fluid ejected through the sampling port.

13. A metering device according to any one of claims 1 to 4 wherein the spool valve has first fluid inlet and a first fluid outlet and a said fluid flow means extending to one end of the chamber all located adjacent one end of the bore, and the spool valve has a second fluid inlet and a second fluid outlet for a fluid that is different from the first fluid and the said fluid flow means extending to the other end of the chamber all located adjacent the other end of the bore, the spool having a central region that is a sliding sealing fit within the bore, with a relatively narrow diameter neck at each end thereof so that the spool may in one position connect the first fluid inlet to the fluid flow path extending to one end of the chamber and connect the second fluid to the fluid flow path extending to the other end of the chamber, and in another position may connect the second fluid inlet to the fluid flow path extending to the said other end of the chamber and connect the first fluid outlet to the fluid flow path extending to the said one end of the chamber.

14. A device according to claim 13 wherein part of the chamber intermediate the ends thereof defines a cavity surrounding part of the shuttle adapted to receive a flow of solvent.

15. A device according to claim 13 or 14 wherein part of the bore of the spool valve intermediate the ends thereof defines a cavity surrounding part of the spool adapted to receive a flow of solvent.

16. A device according to any one of claims 13 to 15 wherein the volume within the chamber that communicates with the flow means at one end of the chamber when the shuttle is at the other end of the chamber is greater than the volume within the chamber that communicates with the fluid flow means at said other end of the chamber when the shuttle is at said one end of the chamber.

17. A device according to claim 16 wherein the shuttle is provided with two shuttle rods of different diameter each extending from a respective end of a central part of the shuttle to the exterior of the chamber.

18. A metering arrangement comprising two or more metering devices according to claim 2 or any claim dependant thereon wherein the control units of the devices are interconnected so that the motor arrangements of the spools of the spool valves of all the units are controlled in response to a signal generated in response to the shuttles of all the units reaching the initial position or the second position.

19. A metering device substantially as herein described with reference to and as shown in Figure 1 of the accompanying drawings.

20. A metering device substantially as herein described with reference to and as shown in Figures 2 to 5 of the accompanying drawings.

21. A metering device substantially as herein described with reference to and as shown in Figure 6 of the accompanying drawings.

22. A method of operating a metering device substantially as herein described.

23. Any novel feature or combination of features disclosed herein.